

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A composition comprising a polysaccharide particle and a cationic additive, wherein the cationic additive is adhered to the polysaccharide particle to provide a polysaccharide particle having a positive surface charge.
2. The composition of Claim 1 wherein the cationic additive comprises a cationic polymer.
3. The composition of Claim 2 wherein the cationic polymer comprises a polyquaternary amine.
4. The composition of Claim 3 wherein the polyquaternary amine has a molecular weight in the range from about 1 million to about 5 million grams per mole.
5. The composition of Claim 3 wherein the polyquaternary amine has about 3 meq quaternary amine per gram.
6. The composition of Claim 1 wherein the cationic additive is present in the composition in an amount from about 1 to about 15 pounds per ton polysaccharide.
7. The composition of Claim 1 wherein the surface charge is in the range from about +1 mV to about +100 mV.
8. The composition of Claim 1 wherein the polysaccharide is selected from the group consisting of corn, potato, tapioca, pea, and wheat starches.
9. A pulp furnish comprising a polysaccharide particle having a positive surface charge, wherein the polysaccharide particle having a positive surface charge comprises a cationic additive adhered to the polysaccharide particle.
10. The furnish of Claim 9 wherein the cationic additive comprises a cationic polymer.
11. The furnish of Claim 10 wherein the cationic polymer comprises a polyquaternary amine.

12. The furnish of Claim 9 wherein the polysaccharide particle has a surface charge in the range from about +1 mV to about +100 mV.

13. The furnish of Claim 9 further comprising an anionic retention aid.

14. The furnish of Claim 9 further comprising a cationic retention aid.

15. The furnish of Claim 13 further comprising a cationic retention aid.

16. The furnish of Claim 13 wherein the anionic retention aid comprises an anionic polyacrylamide.

17. The furnish of Claim 16 wherein the anionic polyacrylamide comprises a copolymer of acrylic acid and acrylamide.

18. The furnish of Claim 17 wherein the copolymer comprises about 30 mole percent acrylic acid and about 70 mole percent acrylamide.

19. The furnish of Claim 17 wherein the copolymer has a molecular weight in the range from about 8 to about 15 million grams per mole.

20. The furnish of Claim 13 wherein the anionic retention aid is present in the furnish in an amount from about 0.1 to about 3.0 pounds per ton fiber.

21. The furnish of Claim 14 wherein the cationic retention aid comprises a cationic polyacrylamide.

22. The furnish of Claim 21 wherein the cationic polyacrylamide comprises a copolymer of acrylamide and a quaternary amine monomer.

23. The furnish of Claim 22 wherein the copolymer comprises about 90 mole percent acrylamide and about 10 mole percent quaternary amine monomer.

24. The furnish of Claim 22 wherein the copolymer has a molecular weight in the range from about 8 to about 15 million grams per mole.

25. The furnish of Claim 14 wherein the cationic retention aid is present in the furnish in an amount from about 0.1 to about 12 pounds per ton fiber.

26. A paper product comprising a polysaccharide particle having a positive surface charge, wherein the polysaccharide particle having a positive surface charge comprises a cationic additive adhered to the polysaccharide particle.

27. The paper product of Claim 26 wherein the cationic additive comprises a cationic polymer.

28. The paper product of Claim 27 wherein the cationic polymer comprises a polyquaternary amine.

29. The paper product of Claim 26 wherein the polysaccharide particle has a surface charge in the range from about +1 mV to about +100 mV.

30. The paper product of Claim 26 further comprising an anionic retention aid.

31. The paper product of Claim 26 further comprising a cationic retention aid.

32. The paper product of Claim 30 further comprising a cationic retention aid.

33. The paper product of Claim 30 wherein the anionic retention aid comprises an anionic polyacrylamide.

34. The paper product of Claim 31 wherein the cationic retention aid comprises a cationic polyacrylamide.

35. The paper product of Claim 26 wherein the paper product is selected from the group consisting of fine paper, newsprint, bleached board, liner board, medium board, and old corrugated cardboard.

36. A method for forming a paper product comprising:
adding a polysaccharide particle having a positive surface charge to a first pulp furnish to provide a second pulp furnish, wherein the polysaccharide particle having a positive surface charge comprises a cationic additive adhered to the polysaccharide particle;

depositing the second pulp furnish onto a foraminous support to provide a wet web; and
dewatering and drying the wet web to provide the paper product.

37. The method of Claim 36 wherein the cationic additive comprises a cationic polymer.

38. The method of Claim 37 wherein the cationic polymer comprises a polyquaternary amine.

39. The method of Claim 36 wherein the starch particle has a surface charge in the range from about +1 mV to about +100 mV.

40. The method of Claim 36 further comprising adding an anionic retention aid to the first pulp furnish.

41. The method of Claim 36 further comprising adding a cationic retention aid to the first pulp furnish.

42. The method of Claim 40 further comprising adding a cationic retention aid to the first pulp furnish.

43. The method of Claim 40 wherein the anionic retention aid comprises an anionic polyacrylamide.

44. The method of Claim 41 wherein the cationic retention aid comprises a cationic polyacrylamide.

45. The method of Claim 36 wherein the paper product is selected from the group consisting of fine paper, newsprint, bleached board, liner board, medium board, and old corrugated cardboard.

46. A method for increasing the strength of a paper product comprising:
adding a polysaccharide particle having a positive surface charge to a first pulp furnish to provide a second pulp furnish, wherein the polysaccharide particle having a positive surface charge comprises a cationic additive adhered to the polysaccharide particle;

depositing the second pulp furnish onto a foraminous support to provide a wet web; and

dewatering and drying the wet web to provide the paper product having increased strength compared to a similarly constituted paper lacking a polysaccharide particle having a positive surface charge.

47. The method of Claim 46 wherein the cationic additive comprises a cationic polymer.

48. The method of Claim 47 wherein the cationic polymer comprises a polyquaternary amine.

49. The method of Claim 47 wherein the polysaccharide particle has a surface charge in the range from about +1 mV to about +100 mV.

50. The method of Claim 47 further comprising adding an anionic retention aid to the first pulp furnish.

51. The method of Claim 47 further comprising adding a cationic retention aid to the first pulp furnish.

52. The method of Claim 50 further comprising adding a cationic retention aid to the first pulp furnish.

53. The method of Claim 50 wherein the anionic retention aid comprises an anionic polyacrylamide.

54. The method of Claim 52 wherein the cationic retention aid comprises a cationic polyacrylamide.

55. The method of Claim 46 wherein the paper product is selected from the group consisting of fine paper, newsprint, bleached board, liner board, medium board, and old corrugated cardboard.

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